Relative Permittivity of 1,1,1,2,3,3,3-Heptafluoropropane (HFC-227ea), 1,1,1,2,3,3-Hexafluoropropane (HFC-236ea) and 1,1,1,3,3-Pentafluorobutane (HFC-365mfc) in the Liquid Phase

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Relative permittivity measurements have been reported in the liquid phase of 1,1,1,2,3,3,3-heptafluoropropane (HFC-227ea), 1,1,1,2,3,3-hexafluoropropane (HFC-236ea) and 1,1,1,3,3-pentafluorobutane (HFC-365mfc). The measurements were performed using a direct capacitance method at temperatures from 223 K to 303 K under pressures up to 16 MPa for HFC-227ea and HFC-236ea. The same method was applied to R365mfc at temperatures from 263 K to 303 K up to 16 MPa. The repeatability of the measurements was found to be of the order of $\pm$ 0.7×10^{-3} and the uncertainty is estimated to be better than $\pm$ 0.7×10^{-2}. The data was correlated as a function of density and pressure. The theory developed by Vedam et al., and adapted by Diguet, and the Kirkwood modification of the Onsager equation for the variation to the modified molar polarization with temperature and density was applied to obtain the dipole moment of HFC-227ea, HFC-236ea and HFC-365mfc in the liquid state. The apparent dipole moment value is 2.36D for HFC-227ea, 2.63D for HFC-236ea and 4.93 for HFC-365mfc. The effective dipole in the liquid state of HFC-236ea (μ_{KF}*) predicted by the Kirkwood-Frolich equation is 2.67D.

Density functional and density functional self-consistent calculations of the electronic distribution and of the dipole moment are reported. Comparison with other fluorocarbons, from the methane and ethane family is reported.